In re Patent Application of:
Ockenfuss ET AL.
Serial No. **10/004,142**
Filed: **November 14, 2001**

IN THE DESCRIPTION

Page 2, lines 9 to 21

B2

The use of multilayer optical interference filters has become ubiquitous in optical communication systems using wavelength division multiplexing (WDM). Such filters are the currently preferred method of separating or combining optical signal channels assigned to different wavelengths, according to the ITU grid, but propagating in common <u>waveguides due</u> ~~waveguidesdue~~ to the minimum of insertion losses. However, the need to increase the number of signal channels that can be utilized within an existing optical fiber structure requires a decrease <u>in</u> wavelength spacing between adjacent channels. At the same time it is desirable to decrease the physical dimensions of active and passive components, such as filters within the switching fabric, as well as to decrease the component cost by integration of filters with other components. Accordingly, the performance requirements of optical interference filters have become more demanding. While the optical performance requirements can be met by increasing the number of layers, the physical properties of such thicker filters present significant challenges to reductions of the physical dimensions and integration with other optical components.

Page 3, lines 20 to 24

B3

The importance of substrate selection in the thermal stability of interference filters is known. The linear coefficient of expansion of the substrate material may be chosen to either shift or stabilize the center wavelength multilayer dielectric bandpass filter with respect to a changing ambient temperature, as demonstrated by H. Takahashi in Applied Optics

B3 34(4) ~~34(40)~~ pp. 667-675, 1995 (misspelled Takashashi in the original publication).

Page 4, lines 23 to 27

B4 Likewise, in US patent 4,826,553 (Armitage et al.) invented a method for removing a mirror coating from its substrate and re-applying it wholly intact onto a second substrate in order to alter the dielectric mirror's figure (curvature). In a later publication, Schmidt, et al (Photonic Spectra, May ~~may~~ 1995) stated that such a method is applicable to lower performance telecommunication filters.

Page 9, lines 4 to 15

B5 Stresses in a thin film can have several components. Intrinsic stresses develop as a thin film grows during deposition owing to the specific microstructure formed therein. Another significant source of stress is due to the differences in the coefficient of thermal expansion of the film and that of the substrate or adjacent film layers causing the different materials to experience different degrees of expansion and shrinkage upon, respectively, heating and cooling. Because typical deposition temperatures are higher than ambient temperatures, stress develops when the temperature changes from the deposition temperature. Even when films are deposited nominally at room temperature, some heating of the substrate can occur during the deposition and condensation process. Finally, temperature variations during use may lead to changes in the stress level. The sign of the thermally induced stress can change from tensile to compressive, or vice versa, as it is a function of the differences in the thermal expansion coefficients of the film and substrate materials. Thus, many factors affect the overall net stress of an optical coating.

In re Patent Application of:
Ockenfuss ET AL.
Serial No. **10/004,142**
Filed: **November 14, 2001**

Page 12, lines 4 to 13

As illustrated in Figure 4, the present release means is to deposit a thin layer 42 of a water-soluble material, preferably an inorganic material. We now employ sodium chloride (NaCl) as the release layer, although other suitable materials are disclosed in the art. This release layer 42 is deposited in a vacuum chamber optimized for that operation. Because water-soluble release materials are environmentally fragile with respect to atmospheric humidity, the release layer 42 is preferably protected from the atmospheric environment by depositing thin protective layers 43 over it. As this layer or layers will separate for the release layer 42 and becomes part or all of the first layer of the final multilayer dielectric bandpass filter, its thickness is controlled accordingly, although it should be at least about 100 nm thick. The sodium chloride layer thickness is preferably between about 10 to 20 nm.

B6

Page 12, lines 14 to 15

The purpose of the protective layer(s) 43 is (are) to isolate the potentially environmentally fragile release layer 42 from atmospheric degradation while awaiting use in the filter deposition system.

Page 12, lines 16 to 20

The substrate 41, prepared with the release layer structure 42, is then introduced into a conventional deposition system suitable for the production of dielectric multilayer filters of the quality required for the intended application. The multilayer dielectric filter is deposited in the usual way,

In re Patent Application of:
Ockenfuss ET AL.
Serial No. **10/004,142**
Filed: **November 14, 2001**

B6

using accepted Physical Vapor Deposition (PVD) or Chemical Vapor Deposition (CVD) or hybrid PVD / CVD methods.

Page 14, lines 11 to 18

B7

Once released from the substrate the unsupported film can be reattached to a second substrate. The second substrate can be another optical component to provide the desired integration by miniaturization as well as combination with other passive or active optical components, such as GRIN ~~grin~~ lenses, prisms, reflectors, detectors, photodiodes, waveguides, lasers, modulators and the like. Alternatively, the attachment of such free standing filters to at least a portion of precision armature can be used to form reflective element in compact optical switches, such as are disclosed in PCT application WO/0039626 entitled "Wavelength Selective Optical Switch" (Scobey et al.), which is incorporated herein by reference.

Page 14, lines 19 to 25

Potential methods of reattachment include mechanical coupling as well as adhesive bonding, which can be direct depending on the chemical affinity of the materials, or through an intermediate adhesive layer, such as well known optical adhesives. Those skilled in the art of optical fabrication will recognize a myriad number of attachment methods are feasible. Optical contacting methods, such as those described in US 5,846,638 and 5,441,803 to Meissner or in US 5,485,540 ~~5,5,485,540~~ to Eda are particularly desirable as they avoid the use of an intermediate adhesive layer, and as such are incorporated herein by reference.

Page 15, lines

B8

The frame is preferably an annular ring, such as a washer, having a suitable thermal expansion coefficient to stabilize the center wavelength of the filter over a wide temperature range. At the same time, the passband retains the desired square shape due to the elimination of residual stress in the coating and the resulting distortion of the first substrate.

Page 16, line 24 to Page 17, line 2

B9

As Figure 6 is intended to be representative rather than limiting, it should be pointed out that a symmetric thermal stress loaded structure may be desirable in some application, accordingly a second frame member can be attached or bonded to other opposite surface of the filter to form the laminated structure illustrated in Figure 7. The optical assembly 71 comprises a first frame 72 that is bonded or otherwise attached to the first surface of optical filter 74 via adhesive layer 73a. A second frame 75 is attached to the second surface of optical filter 74 via a second adhesive layer 73b. Alternatively, the second frame 75 can be attached or bonded to both the optical filter 74 and the first frame 72. Attaching or joining the first frame 72 to the second frame 75 can ~~ca~~ be expected to clamp and functionally ~~functional~~ attach optical 74, eliminating the dependence on adhesives 73a and/or 73b.

Page 17, lines 5 to 10

B10

A further advantage of frame/filter subassembly of Figures 6 and 7 and is that the elimination of the substrate also avoids Fresnel ~~fresnel~~ reflections from the second surface of the substrate (the surface opposite the first surface onto which

B10 the multilayer interference filter is otherwise deposited or attached). Thus, when the interference coating is not otherwise in contact with another optical surface, the additional cost and complexity of providing a high performance antireflection (AR) to the second surface of the substrate is avoided.